Memory Metals

Shape Memory Effect, or SME, is a term for the ability of certain metal alloys to change from one shape to another in response to temperature change, a direct result of a transformation of the alloy's crystal structure. SME technology was developed in the 1960s and NASA renewed interest in it in the 1980s. Among companies awarded contracts for advanced SME investigations was Memry Technologies, Inc., a subsidiary of Memry Corporation, Norwalk, Connecticut which, since 1985, has been working on SME alloys for advanced composite structures and space station applications. That work inspired company development of a spinoff line of civil use products.

Certain metal alloys change from one shape to another in response to temperature change

An SME device can be made to expand when cooled or contract when heated; it may have one-way or two-way "memories." A one-way SME alloy can be deformed, then recover and permanently retain its original shape when heated to a certain temperature. Two-way alloys hold their original shape at one temperature and another shape at a different temperature.

Under its NASA contracts, Memry produced alloys over a wide range of transformation temperatures in sheet, wire, rod and tube form. The company developed several types of one-way memory quick connect/disconnect joints for space station structures and two-way actuators for the disconnect feature.

Adapting its expertise in shape memory characterization and behavior, Memry Technologies moved into the civil market by applying two-way SME alloys to commercial safety products known as MEMRYSAFE® and FIRECHEK®.

MEMRYSAFE products provide protection against scalding in the home; they instantly restrict the flow of water in the shower, bath and sink before scalding temperatures are reached, a feature particularly important for protection of children. The technology developed under NASA contract gave Memry a competitive edge because the special SME alloy used in MEMRYSAFE allows low consumer prices ($15 to $30).

A related consumer product is ULTRAVALVE™, a computer-controlled shower and bath valve **(above)** that allows the user to preselect a preferred bathing temperature. The temperature is

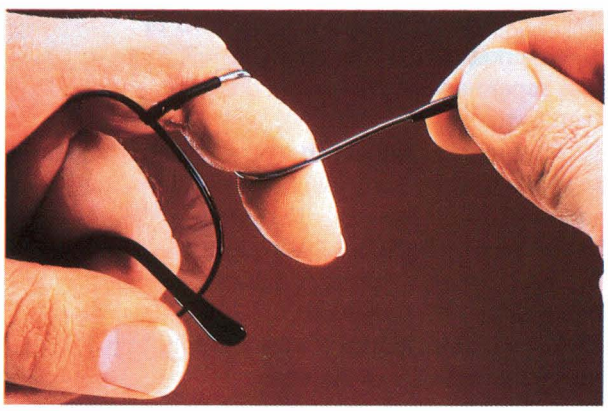
A "smart" eyeglass frame remembers its shape and its wearer's fit

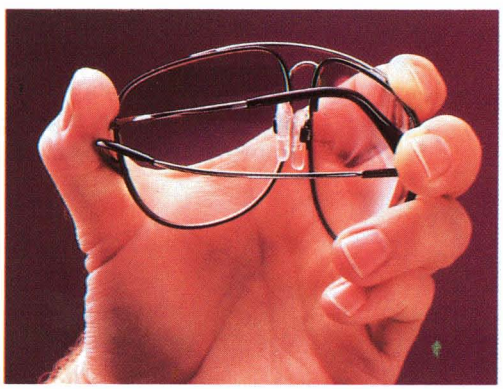
maintained by an automatic electronic control and confirmed by a digital readout **(above)**. A MEMRYSAFE device similar to the anti-scalding unit serves as a mechanical backup to the electronics. This again allows a lower price to the consumer by eliminating the need for more expensive electronic backup circuitry.

The FIRECHEK product that emerged from Memry's SME research is a fire control safety valve **(top right)** for semiconductor industrial process lines containing hazardous gases or fluids; it detects unsafe temperatures and automatically shuts off the pneumatic pressure that operates the control valve. The SME element accomplishes detection and actuation simultaneously and requires no outside power source. Memry Technologies is continuing research toward applying its SME knowhow to a wide range of other commercial products.

Another company — Marchon® Eyewear, Inc., Melville, New York — has applied the memory metal technology in a different manner. Using the NASA technology as a departure point, Marchon is using a patented version of the material in a "smart" eyeglass frame **(bottom, opposite page)** that remembers its shape and its wearer's fit. Frames made with Flexon™ can snap back to their original shape after being wrapped around a finger **(lower left),** bent in half **(below)** or twisted like a pretzel.

Marchon's advancement is a patented "memory encoding process" that gives the special titanium alloy used in the frames its flexible memory: it works at room temperature and does not require heat to return to shape. Flexon frames are marketed under two brands, Autoflex® by Marchon and Accuflex™ by an affiliated company, Marcolin® S.p.A. Marchon sees a large market among some 115 million U.S. wearers of eyeglasses, whose frames will maintain replacement cost of frames smashed or twisted out of shape.





®MEMRYSAFE and FIRECHECK are registered trademarks of Memry Corporation.

™ULTRAVALVE is a trademark of Memry Corporation.

®Marchon is a registered trademark of Marchon Eyewear, Inc.

®Marcolin is a registered trademark of Marcolin S.p.A.

™Flexon and Accuflex are trademarks of Marchon Eyewear, Inc.

®Autoflex is a registered trademark of Marchon Eyewear, Inc.